Electricity and Electrostatics

Activity

- Choose a partner.
- Get one balloon and blow it up.
- Rub the balloon against your partner's hair

and attempt to stick the balloon to any vertical surface.

Questions:

1. Was this task possible? Why or why not?
2. What was the overall affect of the balloon rubbing on your partner's hair?

Review

Protons - positively charged subatomic particles

Electrons - negatively charged subatomic particles

Neutrons - a neutral (no charge) subatomic particle

The Electrical Nature of Matter

Electricity - the circulation or movement of electrons

Electrostatics - the study of static electric charges

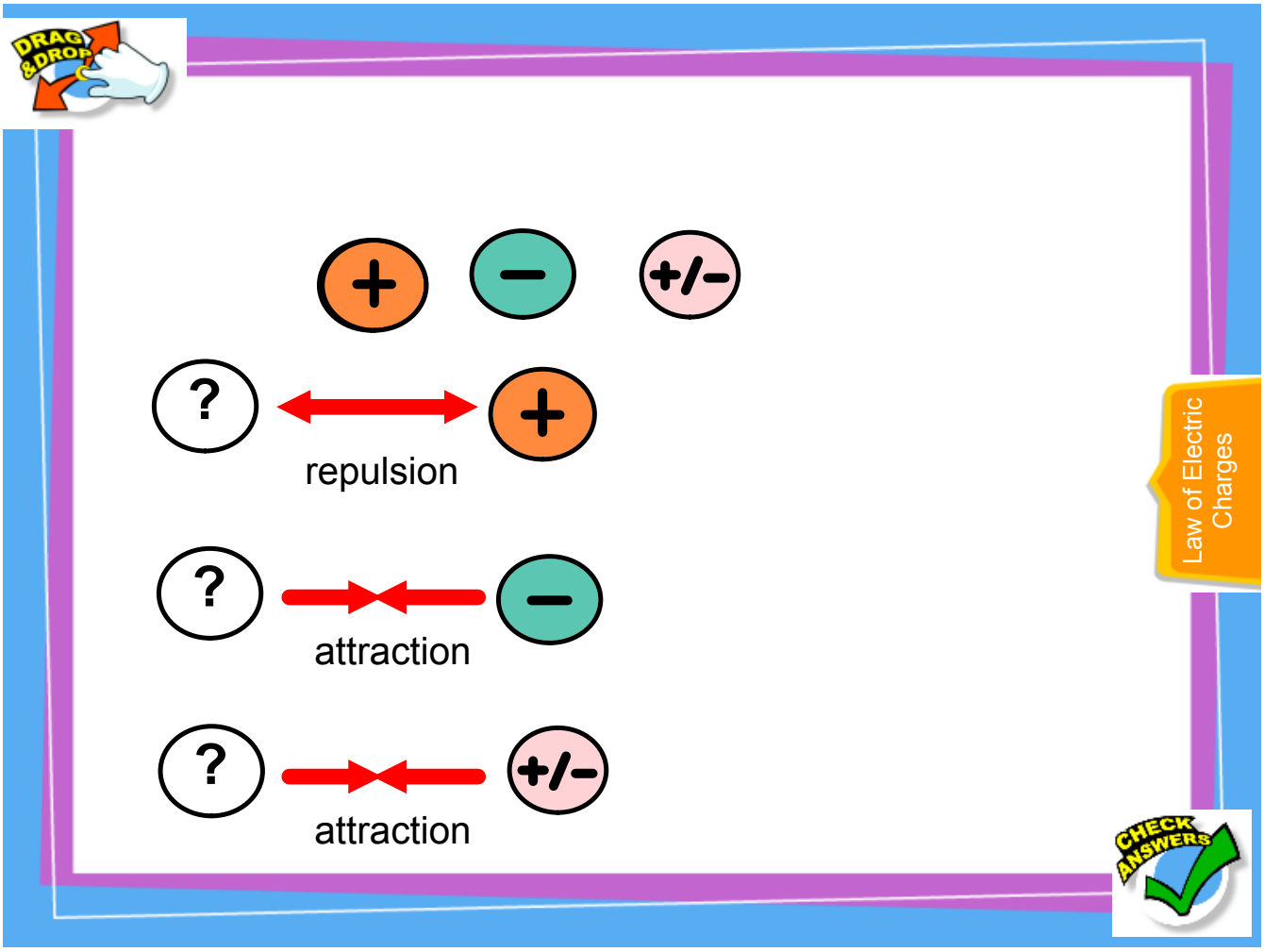
Electric charges - a negative or positive quantity of electricity that builds up on an object

Static electricity - a charge on a substance that stays in the same place on an object

The law of electric charges

In Other Words:

OPPOSITES ATTRACT AND LIKES REPEL


DRAG & DROP
+
−
+/−
?
repulsion
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attraction
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attraction
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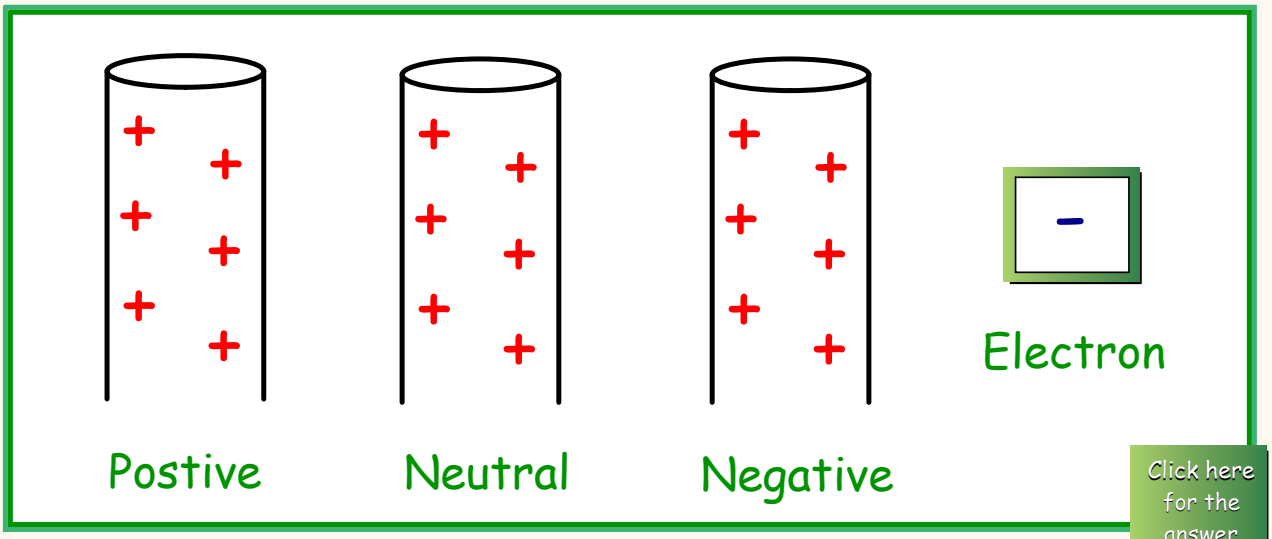
Law of Electric Charges
CHECK ANSWERS

Drag negative charges to these diagrams to illustrate a positively charged object, a neutral object and a negatively charged object.



Charging Objects

There are three basic ways to electrically charge an object:

- Charging by Friction
-
- Charging by Contact
-
- Charging by Induction

Charging by Friction

Transferring an electric charge from one substance to another by a rubbing action.

Example: Walking across a carpet

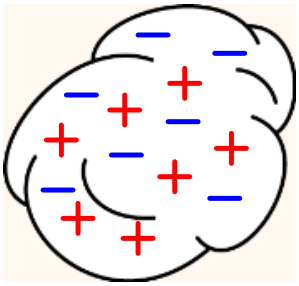
- creates friction between the carpet and the person's shoes produces a charge on both the person (negative) and the carpet (positive).

Since all atoms do not hold onto their electrons with the same attractive force, two dissimilar materials rubbed together will fight for electrons.

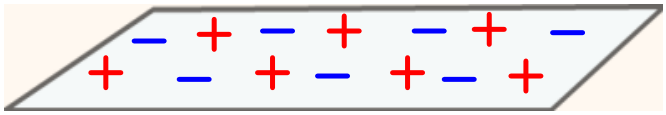
Drag the electrons to the material with the higher affinity.

Pull here

Click here for the electrostatic series



Neutral wool



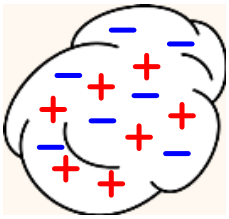
Neutral acetate

Summary: charging by friction

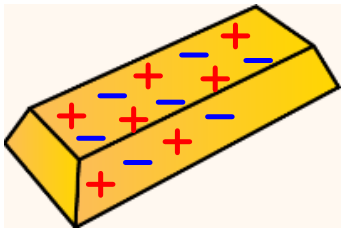
Drag the electrons to the material with the higher affinity.

Pull here

Before

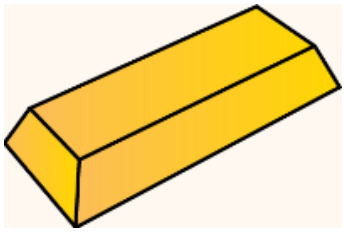


Neutral cotton



Neutral gold

After



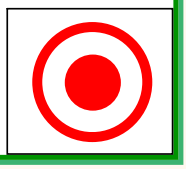
Click here for the electrostatic series

Charging by _____ occurs when two substances are rubbed together. These two substances are initially _____. However, after being rubbed, one object becomes _____ while the other becomes _____. Charging by friction occurs because _____ are free to move from one substance to another. The _____ determines which substance will _____ electrons and which substance will _____ electrons.

Drag this to the target to reveal the answers.

neutral electrons negative gain

friction electrostatic series lose positive



If an object gains electrons then it is said to be _____. If a substance loses electrons it is said to be _____.

For example, if an ebonite rod is rubbed with a small piece of silk, the ebonite will become _____ while the silk will become _____. We use _____ to illustrate the transfer of electrical charge (electrons between two substances.

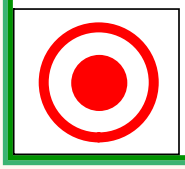
positive

negative

negatively charged

positively charged

charge distribution diagrams



Drag this to the target to reveal the answers.

Charging by Contact

Occurs when one object is electrically charged and passes that charge to another object.

Example: When you touch a doorknob after rubbing your feet across a carpet. The electrical charge from your body is shared with the doorknob.

Charging by Induction

Involves transferring an electric charge from one substance to another without contact.

Example: dust (neutral) sticking to your television (negatively charged).

The Electrostatic Series

Acetate
Glass
Wool
Fur and Hair
Calcium, Magnesium, Lead
Silk
Aluminum and Zinc
Cotton
Wax
Ebonite
Plastic (Polyethylene)
Carbon, Copper, Nickel
Rubber
Sulfur
Platinum and Gold

GAINS ELECTRONS

Insulators and Conductors

Insulator - a substance in which electrons cannot move freely from one atom to another.

Conductor - a substance in which electrons can move freely from one atom to another.

TASK

In groups create a list of at least three conductors and three insulators.

Static Electricity and Winter

Static electricity is more of a problem in winter because cold air is drier and contains fewer water molecules.

Dry air is an insulator, so in winter, any static charge that builds up on our clothes or painted or polished surfaces tend to stay there.

Discharging An Object

Occurs when all the excess electrical charge is removed from an object. There are several ways to discharge an object.

Discharge Methods:

1) Grounding
2) Discharge at a point
3) Exposure to air
4) Exposure to light
5) Exposure to radioactivity

Grounding

Involves a charged object sharing its charge with the ground.

Discharge at a Point

Removes electric charge from pointed objects by pushing the excess charge off the tip or point of the object.

Often seen on aircraft.